



# Climate Change Solutions

## Utah's Solar Project Helps Reduce Greenhouse Gases

A remote marina on Lake Powell in Utah is steering a forward-looking course against global warming. Electricity to run Dangling Rope Marina, formerly supplied by diesel fuel-fired generators, is now produced by renewable energy. Thanks to rows of solar panels—384 in all—and a propane generator backup, fewer fossil fuel emissions are polluting the clean desert air.

The marina, accessible only by boat, is an important center of economic activity on 186-mile-long Lake Powell in the Glen Canyon National Recreation Area. Every year, more than 325,000 of the recreation area's 2.5 million visitors stop at Dangling Rope to visit the ranger station, boat repair facility, grocery store, or the fuel dock. Today, the electricity to run the gasoline pumps comes from the sun, as does the power for the rest of the marina and the homes of the employees.

The photovoltaic system was designed to supply up to 80 percent of the marina's power needs. It is the largest solar power generating facility in the National Park System and one of the largest stand-alone photovoltaic systems in the world.

Dangling Rope's annual emissions will be reduced by 540 tons of carbon dioxide, 27,000 pounds of nitrogen oxides and 5,183 pounds of carbon monoxide.



Gary McKellar, Deseret News

*Dangling Rope Marina, accessible only by boat, provides food to more than 325,000 boaters a year and fuel for their boats.*



Gary McKellar, Deseret News

*Utah energy official Jeff Burks (right) and maintenance supervisor Ron Hockins are dwarfed by Dangling Rope's 384 solar panels.*

Furthermore, with propane as the new backup power, Lake Powell is no longer at risk for diesel fuel spills. Because of solar power, thousands of visitors a year will be able to contemplate the faded sandstone walls of Glen Canyon and the jeweled waters of Lake Powell in peace

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and quiet, without the unwelcome noise of diesel fuel generators. As Jeff Burks, director of Utah's Office of Energy and Resource Planning, says, "This project is the appropriate technology in the appropriate place. For a pristine national recreational area, it's the right fit."

### History of the Project

A public-private partnership made this project work. The Utah Office of Energy and Resource Planning (OERP) launched the Dangling Rope Marina project in 1992, in

response to a grant solicitation from the United States Department of Energy. OERP's preliminary analysis identified Dangling Rope as a prime candidate for conversion to solar power, due to the high cost of transporting diesel fuel to the site and the inefficiency of the marina's generators.

OERP approached the National Park Service (NPS) and found a ready ally in Denis Davis, chief of maintenance at Glen Canyon National Recreation Area. The maintenance chief was concerned about the possibility of

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*"The photovoltaic panels have done an excellent job of providing reliable power to the site."*

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spills during diesel fuel deliveries. The deliveries used to take place every 10 days. A truck loaded with diesel fuel was driven onto a barge and then boated for five hours across the lake.

Park Service managers were troubled by the high cost of energy at Dangling Rope. They also were concerned about the impact of generator noise and air pollution.

Once the Park Service was interested, OERP began an economic and engineering feasibility study. "It was our opinion that in order to convince the Park Service and the Department of Energy and other potential partners to contribute money to construct the project," says Burks, "we

would have to have a very detailed, credible analysis."

The hard work paid off. The State of Utah received \$127,000 from the Department of Energy's Office of Utility Technology, and the state's energy agency committed \$250,000. With \$377,000 in seed money and a 60-page feasibility report in hand, OERP could now attract other organizations to contribute additional funds and technical expertise. EPA's State and Local Climate Change Program provided support to illustrate greenhouse gas reductions from the use of clean energy technologies.

Even so, securing funding was by far the biggest challenge. "It took us three-and-a-half years to get all the funding in place, and about three months to build the photovoltaic system," Burks says.

Before installing the photovoltaic array, the National Park Service conducted an aggressive energy audit to identify opportunities to reduce the electric load of the marina. According to Burks, "Our strategy was based on the premise that it is cheaper to save a kilowatt-hour than to install new capacity to provide it."

Energy-saving retrofits for lighting, refrigeration, space and water heating, laundry dryers, and cooking appliances will be installed with the goal of cutting the marina's energy consumption 36 percent—from 374,000 kilowatt-hours per year to less than 280,000 kilowatt-hours a year.

Construction of the photovoltaic system began on April 23, 1996. On August 30, Utah Governor Michael O. Leavitt and Park Superintendent Joseph F. Alston threw the switch to turn on the 115 kilowatt solar system. Since then, the photovoltaic panels have done an excellent job of providing reliable power to the site.



*Utah Governor Michael O. Leavitt (right) and Park Superintendent Joseph F. Alston prepare to "turn on the sun."*

#### Project Partners

*Utah Department of Natural Resources*

*Utah Department of Community and Economic Development*

*Glen Canyon National Recreation Area (NPS)*

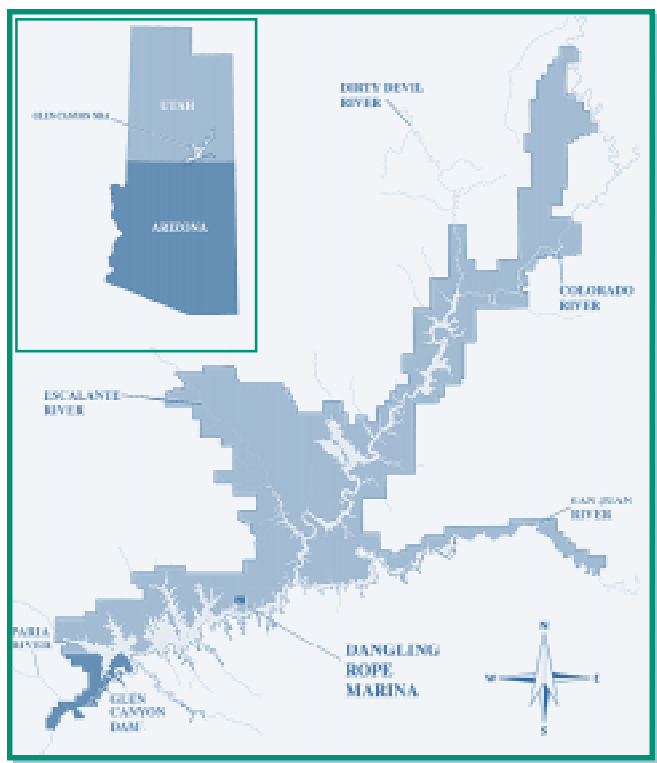
*U.S. Department of Energy*

*U.S. Environmental Protection Agency*

*PacifiCorp*

*Sandia National Laboratories*

*ARAMARK Leisure Services, Inc.*



*Dangling Rope Marina is accessible only by boat.*

## Economics

Dangling Rope Marina is 45 miles from the nearest road or power line. It is surrounded by the plateaus and deep canyons of the Glen Canyon National Recreation Area and the newly created Grand Staircase Escalante National Monument. Connecting the remote marina to the region's power grid would be prohibitively expensive.

Prior to the conversion to solar power, electricity was supplied by two 310-kilowatt diesel fuel-fired generators. They ran 24 hours a day and consumed 65,000 gallons of fuel a year. Fueling the generators required 35 barge trips a year at more than \$1,000 per trip.

The National Park Service estimates that the agency paid \$143,370 for electricity at Dangling Rope in 1991, including maintenance, fuel costs, and barging costs. This works out to \$0.38 per kilowatt-hour, about five times the rate paid by the typical residential customer in Utah.

The total cost of the photovoltaic project, including the energy efficiency improvements, was approximately \$1.5 million. Savings from the new power plant are estimated at more than \$2.3 million over its 20-year life.

The project also has eliminated the risk of a diesel fuel spill, which could cost the Park Service well over \$1 million to clean up. Although environmental "externalities" such as the cost of air pollution were not included in the official cost-benefit analysis, the agency estimates the annual avoided cost of emissions at \$98,000, making the photovoltaics even more cost effective.

"One of the strengths of this project is that it made both economic and environmental sense," claims Burks.

## Lessons Learned

Building effective partnerships is the key to success. Burks identifies several critical elements for successful collaboration.

### *Find knowledgeable champions*

"It's not enough to have a good idea," Burks says. "You need somebody to carry it." Behind the project's success were individuals who believed they were doing the right thing, were able to articulate the benefits of photovoltaic systems, and could mobilize their organizations—and the resources of those organizations—to make the project happen.

### *Assemble an attractive package*

"First and foremost," says Burks, "the project must make economic sense and offer demonstrated environmental benefits." The U.S. Environmental Protection Agency, for example, was attracted to the project because it offered an opportunity to demonstrate viable and cost-effective energy technologies that help curtail greenhouse gas emissions and slash air, water, and noise pollution.

It also helps if the partners receive other tangible benefits, such as high public visibility. In the case of Dangling Rope, the site's location in a national park was a strong selling point. "Everybody loves the parks," Burks says. "It's easy to attract partners when you tell them you're going to do away with dirty diesel fuel-fired electric generation and replace it with a clean source of electricity generated by the sun."



Applied Power Corp.

*Fuel for the diesel fuel-fired generators required 35 barge trips per year at more than \$1,000 per trip.*

PacifiCorp, one of the project's private sector partners, saw a number of gains too. "There were clear and immediate local environmental benefits to eliminating diesel generation and fuel hauling," says David Engberg, the company's director of technology business development. "And we have taken advantage of a number of unique opportunities to offset carbon dioxide emissions as part of our [U.S. Department of Energy] Climate Challenge commitment. But the return we are most interested in is the learning experience with the technology and its applications."

PacifiCorp expects to use photovoltaics and other generating technologies to serve customers who seek choices in meeting their energy needs. Engberg says that on-the-ground experience is valuable in understanding how to use photovoltaics and other renewable energy technologies in the company's future service. "The Dangling Rope project was a real win-win opportunity for us and the other participants."

#### *Share financing*

Obtaining seed money from the Department of Energy and the State of Utah was crucial to leveraging support from other organizations. "No single government agency can go it alone on big projects like these," Burks adds.

#### *Secure technical expertise and support*

Partners must have relevant experience and be committed to making their knowledge available. In this case, PacifiCorp and ARAMARK shared their experience in managing power plants and large construction projects. The Department of Energy, through Sandia National Laboratories, provided invaluable technical assistance, and the Park Service offered logistical support.

#### *Be an informed customer*

The customer acquiring the photovoltaic system must be informed, interested, and have a measurable stake in a successful outcome. The Park Service met all these criteria, making it an ideal partner.

### **Educational Benefits**

Visitors to Dangling Rope Marina will have a first-hand opportunity to learn about the environmental and economic benefits of solar energy. Park rangers will offer interpretive programs explaining how the marina's hybrid solar-propane system demonstrates the expanding

market for photovoltaics. The Park Service also has the chance to inform the public about the risks of global warming and the cost-effective actions that can be taken to cut emissions.

The project has received considerable attention from the media. Dangling Rope was featured on the front pages of five western newspapers and appeared as an inside story in 15 others. Local Utah and Arizona television stations produced more than a dozen news reports. Burks points out that the project's high visibility acts as an important "market pull" that will help accelerate acceptance of renewable energy technology in the minds of consumers.

The success at Dangling Rope also has helped raise awareness of energy efficiency and renewable energy within the Park Service. Agency personnel in Utah are fielding an increasing number of inquiries for information from other Park Service locations, and pockets of expertise on energy efficiency and renewables are growing throughout the national park system.

"Dangling Rope Marina demonstrates all of the classic characteristics that make National Park Service sites ideal candidates for energy efficiency projects and renewable energy systems," Burks asserts. "Comments received suggest that the public loves these systems almost as much as they love the parks."

### ***For More Information***

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